Montana Comprehensive Assessment System (MontCAS CRT)

Grade 10

Common Released Items

Spring 2014

opi.mt.gov

Montana
Office of Public Instruction
Denise Juneau, State Superintendent

For information, contact Measured Progress, P.O. Box 1217, Dover, NH 03821-1217.
Printed in the United States of America.

Science Directions

This Science test contains three test sessions. Mark or write your answers in the Answer Booklet. Use a pencil to mark or write your answers.

This test includes two types of questions: multiple-choice and constructed-response questions.

For the multiple-choice questions, you will be given four answer choices—A, B, C, and D. You are to choose the correct answer from the four choices. Each question has only one answer. After you have chosen the correct answer to a question, find the question number in your Answer Booklet and completely fill in the circle for the answer you chose. Be sure the question number in the Answer Booklet matches the question number in the Test Booklet. The example below shows how to completely fill in the circle.

CORRECT MARK	INCORRECT MARKS
●	❍ ⊙ ◘ ⊘

If you decide to change your answer to a question, erase the wrong mark completely before filling in the circle of the new answer. Be sure you have only one answer marked for each question. **If two circles are bubbled in for the same question, that question will be scored as incorrect.**

If you are having difficulty answering a question, skip the question and come back to it later. Make sure you skip the circle for the question in your Answer Booklet.

For the other types of questions in the Test Booklet, you will be asked to write your answers in the box provided. Read the question carefully. If a question asks you to explain your answer or to show your work, be sure to do so.

You may make notes or use highlighters in your Test Booklet, but you must bubble or write your final answers in your Answer Booklet. **Do not make any stray or unnecessary marks in your Answer Booklet.**

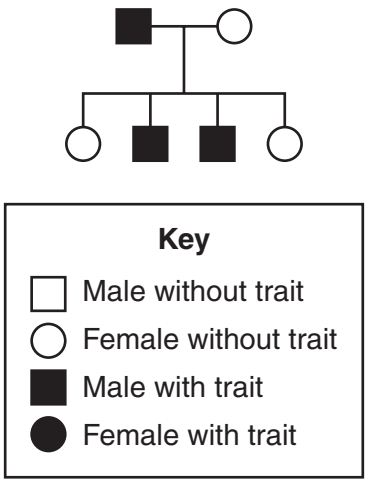
Let's work through a sample question together to be sure you understand the directions.

Sample Question

1. What is the state animal of Montana?
   A. elephant
   B. giraffe
   C. grizzly bear
   D. zebra

Science

1. A student uses the model below to explain a scientific concept.



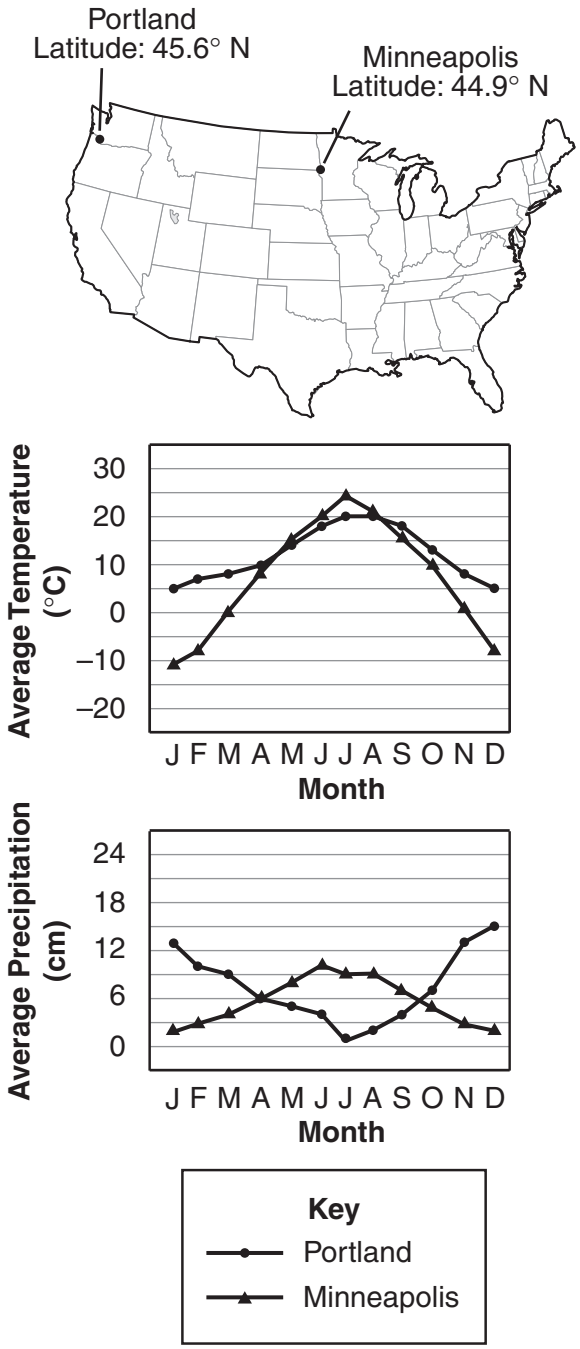
Which concept is the student **most likely** explaining with this model?

A. how a genetic trait is inherited
B. how meiosis distributes genetic traits
C. why only males inherit genetic diseases
D. why only females carry recessive genetic traits

2. A skin cell reproduces by making two new daughter cells. Which molecule is needed to provide the energy to carry out this life process?

A. water
B. a protein
C. ATP
D. a spindle fiber

3. Portland, Oregon, and Minneapolis, Minnesota, have very different climates.



Which factor is the **main** reason for the difference between the climates?

A. latitude
B. nearness to an ocean
C. average annual temperature
D. average annual precipitation

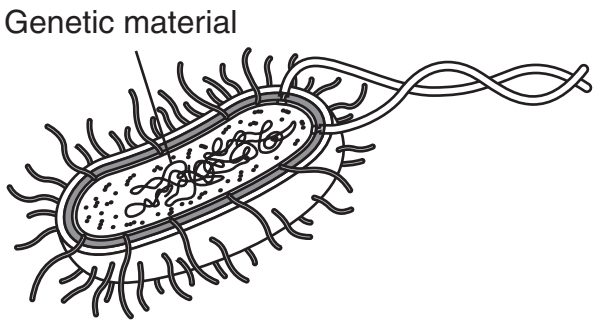
4. Which statement **best** describes how a jet engine moves an airplane forward?

A. Exhaust from the jet engine creates a gravitational force.
B. Exhaust from the jet engine creates an electromagnetic force.
C. As exhaust from the jet engine accelerates backward, an equal and opposite force is created.
D. As exhaust from the jet engine accelerates downward, an equal and perpendicular force is created.

5. According to the nebular hypothesis, which phrase describes a part of the solar system's history that took place before the Sun formed?

A. the formation of a black hole
B. the condensation of a red giant
C. the collision of many small protoplanets
D. the collapse of a large cloud of dust and gas

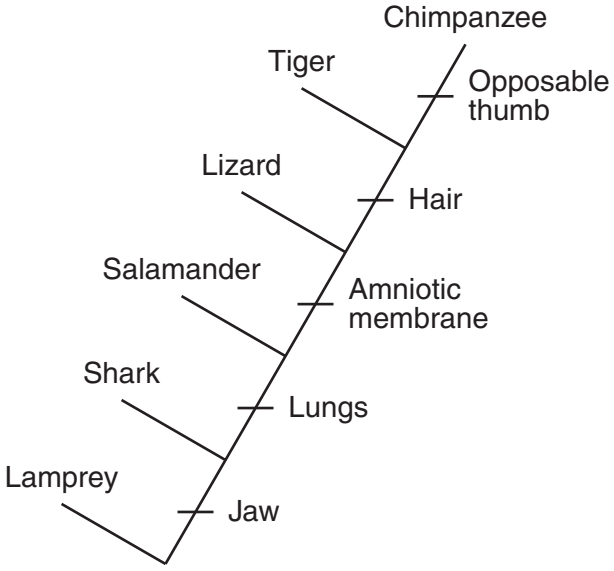
6. The bacterial cell shown below contains genetic material.



What macromolecule makes up **most** of the genetic material?

A. carbohydrate
B. lipid
C. nucleic acid
D. protein

7. The cladogram below shows relationships among six vertebrates.



Which statement is supported by the cladogram?

A. Salamanders and sharks are in the same family.
B. Both salamanders and lizards have amniotic membranes.
C. The common ancestor of all these organisms had a jaw and lungs.
D. Chimpanzees and tigers are the only represented organisms with hair.

8. Historical weather data for Yellowstone National Park is shown in the table below.

Average Annual Data	Source	
	A 1 site: 80 years of data	B 35 sites: 48 years of data
Maximum temperature (°F)	50.3	52.8
Minimum temperature (°F)	19.6	27.6
Total rainfall (in.)	21.6	15.4

Source A averaged data collected for 80 years from one site in the park. Source B averaged data collected for 48 years from 35 sites in the park. Which statement shows the **best** understanding of the data?

A. Source A's site had more rain per year than any other sites in the park.
B. Some of Source B's sites had less rainfall than Source A's site.
C. The minimum temperature for Source A's site is too low and should be revised.
D. Source B needs to collect rainfall data for 32 more years to increase its average.

9. Plants growing at high altitudes tolerate short growing seasons, high winds, cold, and drought. Which kinds of plants are **most likely** to be seen at high altitudes?

A. tall deciduous trees
B. low-growing evergreens
C. tall grasses and cattails
D. ferns and mosses

10. Which shape does the DNA molecule most closely resemble?

A. a pretzel
B. a doughnut
C. a twisted ladder
D. a coiled rope

11. A rock common to the Beartooth Mountains in Montana is made of coarse-grained interlocking crystals. This rock is used for making kitchen countertops, flooring tiles, and monuments. How did this rock form?

A. by magma cooling slowly deep within Earth
B. by lava cooling quickly on Earth's surface
C. by decaying plants being compacted under enormous pressure
D. by sediments deposited on the ocean floor being cemented together

12. The nucleus of a helium (He) atom has a +2 charge and an atomic mass of 4.

    a. Describe the subatomic particles and their locations in a neutral helium atom. Include a description of the charge of each particle and a comparison of their masses.

    b. Explain what makes an atom electrically neutral.

Scoring Guide

Score	Description
4	Response demonstrates a thorough understanding of the structure of an atom, including knowledge of the subatomic particles and their relative masses, charges, and locations within the atom. Response includes a description of the subatomic structure of helium and an explanation of what makes an atom electrically neutral. Response includes no or one error or omission.
3	Response demonstrates a general understanding of the structure of an atom, including knowledge of the subatomic particles and their relative masses, charges, and locations within the atom. Response includes a partial description of the subatomic structure of helium and an explanation of what makes an atom electrically neutral. Response includes two or three errors or omissions.
2	Response demonstrates a limited understanding of the structure of an atom, including knowledge of the subatomic particles and their relative masses, charges, and locations within the atom. Response includes a description of the subatomic structure of helium or an explanation of what makes an atom electrically neutral. Response includes four or five errors and omissions.
1	Response demonstrates a minimal understanding of the structure of an atom, including knowledge of the subatomic particles and their relative masses, charges, and locations within the atom. Response includes a minimal description of the subatomic structure of helium or a partial explanation of what makes an atom electrically neutral. Response has one to four correct pieces of information and contains several errors or omissions.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes

a. The helium atom has four particles in the nucleus: two protons and two neutrons. The protons each have a charge of +1, and the neutrons have a charge of 0, giving the combination the +2 charge. Each atomic particle in the nucleus has a mass number of 1, giving the combination a mass of 4. Thus, the neutral atom must have two electrons, each with a charge of –1, orbiting the nucleus. The mass is concentrated in the nucleus, with the proton and neutron masses being approximately equal and much greater than that of the electron.

   Summary: structure of helium:

Inside the nucleus:	2 Protons	Charge: Positive	Mass: 1 each (total of 2)
	2 Neutrons	Charge: Neutral	Mass: 1 each (total of 2)
Outside the nucleus:	2 Electrons	Charge: Negative	Mass: very minimal

   Note: Part (a) has 12 possible responses, including naming the three subatomic particles. However, for a student to receive a point 4 score, they must give information on all parts asked, but there is room for an error.

b. For an atom to be electrically neutral, the charge inside the nucleus is equal to the charge outside the nucleus. This means that the number of protons and number of electrons is equal.

Part (a) is worth 9 points, and part (b) is worth 1 point.

Point conversion:

9 or 10 pts = 4 pts [see note on part (a)]
7 or 8 pts = 3 pts
5 or 6 pts = 2 pts
1–4 pts = 1 pt

Example of Score Point 4
Sample 1

(A) There are three parts to this hellium atom, it's protons and neutrons in the nucleuse as well as it's electrons in their electrons. A proton and a neutron are equally weighed and make up the atomic mass while electrons weigh nearly nothing. However the charges are a different story Neutrons have no charge, Protons are positive and electrons are negative.

(B) An atom is electrically neutral because protons are matched by electrons thus cancelling out any electrical charge

He:

●=Neutron
O=Proton
•=Electron

Example of Score Point 4
Sample 2

a) In a neutral helium atom there are electrons in the electron cloud, protons in the nucleus and neutrons in the nucleus. Electrons have a negative charge and weigh barely anything, so much so that they are not realevant in the mass of the atom. Protons have a positive charge and take up ^about half of the weight. Neutrons have no charge and take up about half of the weight of the atom.

b) When an atom is neutral it means that there are the same ammount of protons and electrons. If the atom is negative ^in it has ^charge gained more electrons. When the atom has a positive charge it means the atom has lost electrons.

Example of Score Point 3
Sample 1

a.) electrons have a negative charge and are located in the outter shell.
Nutrons have no charge and are in the nucleus of an atom
Protons have a possitive charge and are in the nucleus.
b.) The atom is electrically neutral when it's outtermost shell is filled with the correct amount of electrons

Example of Score Point 3
Sample 2

(a) A neutral helium atom contains:
1) A nucleus composed of:
a) two protons (positively charged)
b) two neutrons (neutral charge)
2) A shell of two negatively charged electrons in orbit around the nucleus

(b) An atom is electrically neutral if the number of protons (+ charged) is equal to the number of electrons (- charged) and therefore has a net charge of zero.

Example of Score Point 2
Sample 1

The helium atom has 2 protons as well as 2 electrons. The protons and the neutrons make up the atomic mass. the electrons float around the atom

Example of Score Point 2
Sample 2

a. In a helium atom there are 4 protons with a positive charge and six electrons with a negative charge. The mass of each proton is 1 and the mass of each electron is 0.

b. An atom is electrically neutral if it has 8 electrons

Example of Score Point 1
Sample 1

a.) There are 4 protons 4 neutrons and 2 electrons
b.) The # of electrons and protons are proportional

Example of Score Point 1
Sample 2

a) the Helium(HE) is neutrial. It has the same amount of elctions, Neutrons, and protons. the outer layer of the atom is an even number and its layer isn't full.

b) when another atom that is uneaven and bigger is by it the first atom connects and take on more charge makeing it electricly neutral

Example of Score Point 0
Sample 1

Well Helium has it number mass of four. and a charge at 2. So When your comparing things look at the atoms mass.

Example of Score Point 0
Sample 2

A They are located in the nucleus and Combine with other elements to make somethingelse.
B. I has an even number of electrons.

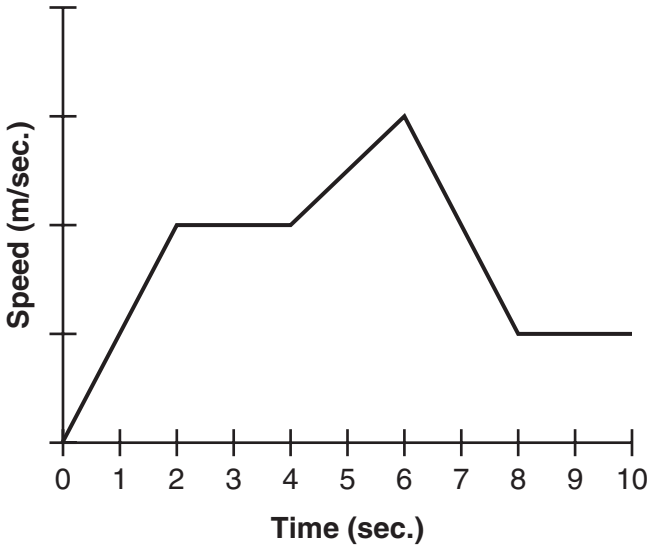
13. Of the following, which has had the **greatest** effect on technology since the late 1800s?

A. a greater understanding of Newton's laws
B. the invention of the steam engine
C. a greater understanding of Einstein's theories
D. the ability to generate and transmit electricity

14. Owls form pellets of fur and bones from the prey they eat. Two students hypothesize that every pellet from the same owl contains the same number of bones. Alice dissects three pellets and Dan dissects five pellets, each from the same owl. Alice reports fewer total bones than Dan. The students conclude that their hypothesis was not supported. Which statement **best** describes why this investigation is or is not valid?

A. The investigation is valid. It shows that Dan's pellets contained larger prey than Alice's and left fewer bones.
B. The investigation is valid. It shows that Alice's pellets were smaller than Dan's.
C. The investigation is not valid until Alice and Dan weigh the bones.
D. The investigation is not valid until Alice dissects two more pellets.

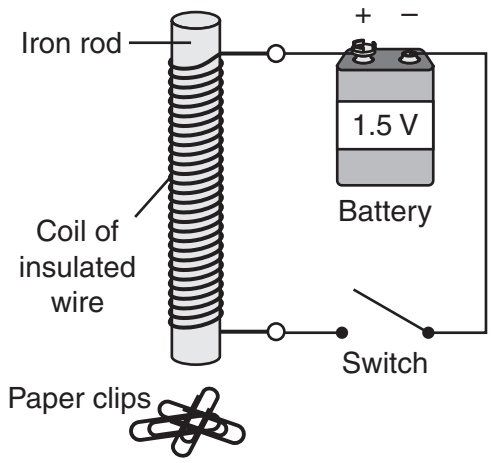
15. The graph below shows the speed of a particle over a 10-second time period.



During which time period does the particle have a positive acceleration?

A. between 0 and 2 seconds
B. between 2 and 4 seconds
C. between 6 and 8 seconds
D. between 8 and 10 seconds

16. The diagram below shows a simple electromagnet that can pick up paper clips.



Which change will increase the number of paper clips that the electromagnet can pick up?

A. reducing the number of coils of wire
B. using an iron rod with a longer length
C. replacing the iron rod with a wooden rod
D. adding another battery to the circuit

17. Nitrogen dioxide reacts with water to form a strong acid called nitric acid (HNO_3). The equation of the chemical reaction is shown below.

$$3NO_2\,(g) + H_2O\,(l) \rightarrow 2HNO_3\,(aq) + NO\,(g)$$

Which is the same on both sides of the chemical equation?

A. the number of atoms
B. the amount of water
C. the number of molecules
D. the amount of the gas NO

18. Curly leaf pondweed is a non-native plant species that is found in some lakes in Montana. Curly leaf pondweed can rapidly root from leaves and pieces of stems. It is transported by boats from lake to lake. What is the **most likely** result if curly leaf pondweed does well in Montana and continues to spread?

A. Biodiversity will increase in lake ecosystems in Montana.
B. Water quality will increase in lake ecosystems in Montana.
C. Curly leaf pondweed will compete with native plants for resources in Montana.
D. Curly leaf pondweed will evolve into a native plant species in Montana.

19. Where do earthquakes occur **most** frequently?

A. at the North Pole
B. at tectonic plate boundaries
C. in the middle of a continent
D. in the middle of a tectonic plate

20. The fermentation reaction forms alcohol from sugar, as shown in the chemical reaction below.

$$C_6H_{12}O_{6\,(aq)} \rightarrow 2\,C_2H_5OH_{(aq)} + 2\,CO_{2\,(g)}$$

Which observation is evidence of a chemical change?

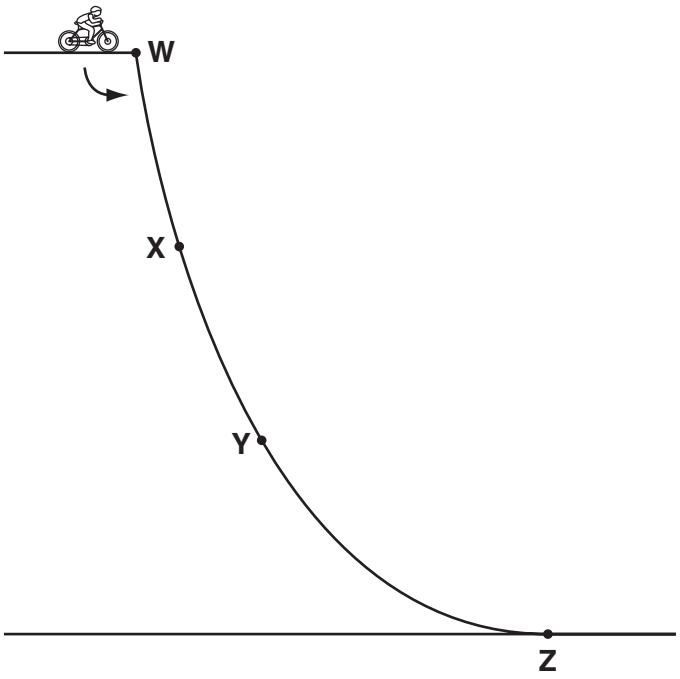
A. CO_2 gas is released.
B. Sugar is dissolved.
C. Alcohol contains carbon.
D. Alcohol contains oxygen.

21. Which information can fossils of invertebrates provide?

A. absolute ages of rocks
B. color of extinct organisms
C. evidence of a change in climate
D. size of living populations

22. A bicyclist rides down a hill, as shown in the diagram below.

Bicyclist on a Hill



At which point on the hill will the bicyclist's kinetic energy be closest to zero?

A. point W
B. point X
C. point Y
D. point Z

23. In 2006, the International Astronomical Union voted to change the definition of a "planet." Pluto's status was changed from a planet to a dwarf planet. Which reason **most likely** led to the change in Pluto's status as a planet?

A. Better telescopes revealed that Pluto's orbit changed.
B. Better telescopes discovered planets outside the solar system.
C. Better telescopes revealed that Pluto's size and shape changed.
D. Better telescopes changed the understanding of planetary systems.

24. Montana has lost over 25% of its original wetlands. Wetland resources are respected and used by Montana Indian communities for traditional shelters, food, and medicine, among other things. Which method would be **most** effective for Montana Indian communities to use to reverse wetland losses on their reservations?

A. introducing invasive aquatic weeds into wetlands
B. using color infrared photography to map wetlands
C. developing conservation plans to restore wetlands
D. building a database containing information about wetlands

25. A student investigates soil samples using the procedure in the box below.

> 1. Choose six different types of dry soil samples.
> 2. Fill a 1000 mL beaker up to the 500 mL mark with the first soil sample.
> 3. Measure 500 mL of water into a graduated cylinder.
> 4. Slowly pour water from the graduated cylinder into the beaker containing the soil sample until the water level reaches the top of the soil (saturation).
> 5. Record the amount of water used to achieve saturation.
> 6. Repeat steps 2–5 using each of the other types of dry soil samples.

What is the independent (manipulated) variable in this investigation?

A. the type of soil used
B. the amount of soil used
C. the type of fluid used to saturate the soil
D. the amount of water used to achieve saturation

26. The Mars rovers *Spirit* and *Opportunity* were launched to gather information about the composition of rocks and soil on the surface of Mars. Which question will **most likely** be answered by the rovers' information?

A. Is there any water on Mars?
B. Can humans safely colonize Mars?
C. Does Mars meet all the criteria to be a planet?
D. Will the orbit of Mars eventually collapse into the Sun?

27. Which statement about bacteria is a testable hypothesis?

A. Bacteria are classified as prokaryotes.
B. Temperature affects the rate of bacterial growth.
C. The evidence clearly shows that bacteria grow well on agar plates.
D. The amount of light is kept constant when measuring bacterial growth.


measured
progress